

REMARKS

I. Claims Pending

Applicants request clarification concerning what claims currently are pending in this application. Applicants' prior amendment requested that claims 3, 15-17, 36, and 47-49 be cancelled without prejudice. The outstanding Office action states that claims 3 and 36 are still pending. Moreover, the Office action states that claims 59-88 are both withdrawn from consideration and rejected. There is no statement in the Office action as to why claims added by applicant in response to the previous amendment, including claims objected to and rewritten in independent format to include the limitations of the base claim and intervening claims, should be withdrawn from consideration. Applicants believe that, after entry of this amendment, claims 1-2, 11-14, 18-22, 24-29, 34-35, 42-44, 46, 50-58 and 65-88 will be pending in the application.

II. Drawings

Paper No. 11, the Office action dated April 11, 2002, objected to applicants' drawings. Applicants' amendment filed on August 1, 2002, responded to this drawing objection and attached Fig. 11 with applicants' proposed amendments indicated in red ink. A second, courtesy copy of Fig. 11 with applicants' proposed amendments is attached. Reference number 73 was added to indicate the threaded rod mentioned on page 22, line 15, of the application. Reference number 78, denoting an aperture similar to aperture 79, is extraneous and was eliminated by applicants' proposed drawing change. No new matter was added by applicants' requested amendments, and applicants requested the Examiner's approval of the amended drawings.

Nothing in the Office action dated December 6, 2002, indicates that the Examiner considered applicants' drawing proposal. The objection to Fig. 11 and the requirement for a proposed drawing amendment are repeated.

Applicants request entry of the proposed drawing change, and an affirmative indication by the Examiner that the drawing objection has been addressed.

III. Claim Rejections – 35 U.S.C. § 102

Claims 1-3, 11, 13-14, 18-22, 24-29, 33-36, 42-44, 46 and 50-58 are rejected under 35 U.S.C. § 102 as allegedly being anticipated by U.S. Patent No. 5,932,940 (Epstein). Applicants traverse this rejection and request that it be withdrawn.

First, applicants' previous amendment expressly canceled claims 3, 15-17, 36 and 47-49 without prejudice. Claims 3 and 36 remain rejected. Applicants request withdrawal of the rejection of these two claims in view of their previous cancellation.

Second, applicants have amended independent claims 1, 28 and 34 to recite additional features to further highlight distinctions between applicants' claimed embodiments and the subject matter disclosed by Epstein. Applicants previously amended independent claims 1 and 34 to recite eliminating the fixture bridge by "applying an electric current across the fixture bridge". Applicants reiterate that Epstein does not expressly state using an electric current to eliminate the fixture bridge, but instead relies on a trench etch process to release the disks (column 55, line 30) and rotors (column 56, line 20). Because Epstein does not disclose releasing a fixture bridge by applying an electrical current, claims 1 and 34 are not anticipated by Epstein.

Applicants also have amended independent claims 1, 28 and 34 to concern using metals or metal alloys, known in the art as bulk metals, as opposed to semiconductor materials or semiconductor layers having metallic layers deposited thereon as taught by Epstein. Support for applicants' requested amendment can be found throughout the application, which generally discusses laminae materials, and material thicknesses typical of laminae, for use when practicing the method of the present invention. For example, page 8 of the application, lines 10-17, states:

In one aspect of the invention, laminae are formed from a variety of materials, particularly *metal shims*. Any *metal or metal alloy* can be used for the microlamination method of the present invention, and hence the proper selection of a *metal or metal alloy* for a particular application will be determined by other factors, such as the physical properties of the metal or metal alloy and cost. Examples of *metals and alloys particularly useful* for metal microlamination include *stainless steel, carbon steel, phosphor bronze, copper, graphite, and aluminum*. (Emphasis added)

Epstein does not teach using lamina made from bulk metals, but instead concerns semiconductor materials, and perhaps semiconductor materials having a very thin, e.g., less than about 10 microns thick, metal layer deposited on the semiconductor substrate. These deposited layers are not self supporting. Deposited layers are different from bulk metals in several respects, including thickness (it would be prohibitively expensive to form metal lamina by deposition on a substrate to achieve lamina thicknesses typically used with the present invention) and physical properties. See, paragraph V of the accompanying Rule 132 Declaration by Professor Brian Paul, which discusses Epstein's use of semiconductor or thin-film metals in more detail.

Applicants also have amended independent claims 1 and 34 to further establish that the fixture bridge being eliminated by the present process is internal to the structure. All of Epstein's examples concern working with structures that can be seen by the operator, as they are on an *external* portion of the device being formed. This is an important distinction. Applicants' invention allows the construction of moveable parts in very small scale devices, where the moveable part is internal to the device. No line of sight allows the internal device to be seen by an operator and yet the internal component can be released by eliminating the fixture bridge. Epstein's patent does not teach or suggest a process whereby such internal components can be released. See, paragraphs III and IV of the accompanying Rule 132 Declaration by Professor Brian Paul, which discusses Epstein's limitation of having to dissociate a structure from a substructure explicitly only on the outside of a bonded lamina stack. The present invention provides a method that is not limited to dissociating structures from substructures on external portions of devices, and hence Epstein does not anticipate applicants' claimed invention.

Furthermore, the present method provides a substantial improvement over the Epstein process by providing process steps, not suggested by Epstein, which allow dissociation of structures internal to a lamina stack. Hence, Epstein also does not render obvious claims 1 and 34. While Epstein does provide a list of potentially applicable machining processes, including electro-discharge milling, these processes are not specifically associated with the removal of fixture bridges. See Epstein, column 58, lines 38-42. Electro-discharge milling is incompatible with the removal of any structures on the devices described in Epstein's specification. First, electro-discharge milling works best with materials of high conductivity. The refractory ceramics, such as silicon and silicon carbide, which make up all, or at the very least, the bulk of

Epstein's devices, are not as conductive as metals. Second, in order to be reasonably selective, electro-discharge milling must be applied to well-defined conductive channels between well-defined electrodes. Such channels and electrodes are not described in Epstein's specification and the incorporation of such features into Epstein's device would not be obvious to one skilled in the art. Epstein even admits, after listing the machining processes, that "many of the geometries and tolerances in the microcomponentry designs are more preferably produced by a microfabrication process." See Epstein, column 58, lines 42-44.

Applicants' independent claims 1, 28 and 34 refer to applying an electrical current (certain claims state "applying an electrical potential") **across** the fixture bridge. Applicants assert that Epstein does not teach or suggest using electro-discharge milling to remove a fixture bridge. Even if, solely for sake of argument, Epstein does teach removing a fixture bridge by electro-discharge milling, Epstein does not teach applying a current or potential **across** the bridge. This is because electro-discharge milling works by creating a potential between a mandrel and the article itself, not across the fixture bridge. This points to a further distinction between certain embodiments of applicants' invention, e.g., such as the embodiment recited in claim 28, relative to Epstein. Assuming Epstein were to attempt to remove a fixture bridge by electro-discharge milling, the mandrel must be brought into sufficiently close physical proximity to the fixture bridge to allow an arc from the mandrel to a portion of the fixture bridge. This requires that the fixture bridge be on an exterior portion of the device. This is not required for applicants' invention, as an electric current can be established across a fixture bridge simply by contacting the overall structure with an electrode. Applicants' invention therefore provides a significant advantage for eliminating fixture bridges located in an interior portion of a device. This is a feature which Epstein cannot achieve, even assuming *arguendo* that Epstein teaches using electro-discharge milling to eliminate fixture bridges.

Applicant's claims 73 and 87 recite a fixture bridge made from a non-refractory material. This is not taught or suggested by Epstein. Instead, the use of a refractory ceramic or another refractory microelectronic material is essential to Epstein. Throughout Epstein these materials are cited as the preferred materials of construction. See, for example, Epstein column 11, lines 25-26; column 12, lines 1-64; and the attached Rule 132 Declaration by Professor Brian Paul. Even the alternative materials cited by Epstein are limited to refractory metals and refractory metal alloys as well as intermetallic compounds. See Epstein, column 13, lines 6-14. And, as

currently understood, Epstein does not teach using bulk refractory metal as with certain embodiments of applicants' invention. Rather, Epstein teaches applying such compounds, such as by CVD, as thin coatings for other materials of choice taught by Epstein, such as a refractory ceramic or other refractory microelectronic material. Refractory materials are characterized by their extremely high boiling points. This property is integral to the function of the devices described by Epstein. For instance, Epstein states that the ability of silicon carbide and silicon nitride to withstand high operating temperatures eliminates the need for combustor wall cooling. See Epstein, column 34, lines 7-16. The extremely high boiling points of these materials, the same feature extolled by Epstein, also makes fixture bridges made from such materials particularly ill suited for elimination by electrical current.

Although Epstein often states that the devices it describes can be made of a variety of alternative materials, the methods of fabrication described by Epstein actually only work on a narrow range of refractory ceramics. All of Epstein's processes rely to some extent on trench etching of silicon wafers. Epstein even acknowledges that trench etching is not practical on other refractory materials suggested in the patent, including silicon carbide. See Epstein, column 57, lines 12-26. For such materials, Epstein briefly contemplates depositing the materials into molds of patterned silicon by means of a CVD process. See Epstein, column 57, lines 26-37. This is not practical. Considering that Epstein's processing steps are generally incompatible with non-refractory materials, it would not be obvious to one skilled in the art to employ such materials in conjunction with any of the processing steps suggested by Epstein.

IV. Claim Rejections – 35 U.S.C. § 103

Claim 12 was rejected as allegedly being obvious over Epstein under 35 U.S.C. § 103 in view of U.S. Patent No. 4,647,748 (Glassman). Applicants traverse this rejection and request that it be withdrawn.

Claim 12 depends from claim 1 and is allowable over Epstein for the reasons stated above for claim 1. Glassman does not provide the features of applicants' claims that are not taught or suggested by Epstein. For example, Glassman teaches using carbon-tipped electrodes for electro discharge milling. As discussed above, the materials taught by Epstein generally are not sufficiently conductive to be used in electro discharge milling processes. Therefore, there is no suggestion to combine the teachings of Glassman with the teachings of Epstein.

V. Dependent Claims

All rejected dependent claims depend from a rejected independent claim and are allowable for the reasons stated for each independent claim. Each of the dependent claims is further allowable in view of the patentable combination of features recited in such dependent claim.

For example, dependent claims 27 and 58 and dependent claim 86 refer to the production of meso-scale devices. Applicants submit that Epstein teaches away from application of its techniques to the production of meso-scale devices. See paragraph VI of the accompanying Rule 132 Declaration by Professor Brian Paul. Epstein cites production in the micro-size realm as the primary way to overcome the limitations caused by the brittleness of refractory materials. See Epstein, column 12, lines 35-45. This suggests to those of ordinary skill in the art that constructing larger sized devices with Epstein's processes would not be practical, and may not be possible. Since applicants are not limited to using brittle refractory ceramics, applicants may produce larger devices without encountering the material limitations discussed by Epstein. Indeed, applicants' preferred embodiment is primarily focused on the production of meso-scale and larger devices.

VI. Objected-To Claims

Claims 15-17 and 47-49 were objected to as being dependent on a rejected base claim. While applicants disagree with the rejection of the underlying independent claims, applicants do agree that the objected-to claims are allowable in independent form. Applicants have cancelled claims 15-17 and 47-49 without prejudice. Applicants also rewrote claims 15 and 47 in independent form as new independent claims 65 and 70 as suggested by the Examiner. Applicants therefore request that the Examiner acknowledge the allowability of these claims. Claims 16 and 17 were rewritten as depending on newly added independent claim 65. Claims 48 and 49 were rewritten as depending on newly added independent claim 68.

The Office action dated December 6, 2002, makes no mention of applicants' rewritten claims, and yet these claims should be allowed, and not objected to based on applicants adoption of the Examiner's indication that such claims would be allowed if rewritten to include the features of the base claim and any intervening claims. Applicants request an affirmative acknowledgment by the Examiner that claims 16, 17, 48, 49, 65, 67 and 68 are allowed.

VII. Claims Added in Response to Previous Office action

In addition to the independent versions of the objected-to claims, applicants added several other new claims. Newly added independent claim 73 recites a fixture bridge made of a non-refractory material. This claim is supported by applicants' specification on page 8, lines 10-17. Since Epstein does not teach the application of its processes to materials other than refractory ceramics, as discussed above, this claim is not anticipated nor rendered obvious by Epstein.


Newly added independent claim 86 recites internal laminae, fixture bridge(s) made of a non-refractory material and the elimination of fixture bridge(s) by the application of electrical current. None of these features is taught or suggested by Epstein as discussed above, and hence the combination of these features cannot be taught or suggested by Epstein, or Epstein in combination with Glassman.

VIII. Conclusion

For the above set out reasons, it is respectfully submitted that all of the claims now in the application define over the cited prior art, are neither anticipated nor made obvious by the prior art, and should be allowable. A Notice of Allowance is respectfully requested.

Respectfully submitted,

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